Community-Acquired Methicillin-Resistant Staphylococcus Aureus (CA-MRSA): Fort Benning, Georgia Jan 2001 - Dec 2005

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Abstract

Background: An increasing number of community-acquired methicillin-resistant *Staphylococcus aureus* (CA-MRSA) skin and soft tissue infections have been observed in military communities. CA-MRSA has been particularly problematic at basic and advanced individual training posts such as Ft. Benning where Soldiers train and work in close proximity under stressful conditions.

Methods: Electronic medical and laboratory records for all CA-MRSA confirmed infections among Ft. Benning Soldiers (January 2001 through December 2005) were reviewed by the Martin Army Community Hospital (MACH) infection control nurse. The data extrapolated were used to assess disease trends and antibiotic susceptibility patterns of the CA-MRSA isolates.

Results: A total of 1,935 CA-MRSA confirmed infections, affecting 1,733 Soldiers, occurred over the 5 year period. Rates increased each year, and cases clustered among initial entry training units. Approximately 11% of the CA-MRSA cases were serious enough to warrant hospitalization. The majority of isolates had moderate to high antibiotic resistance levels to commonly prescribed antibiotics. Recommended treatments (i.e. trimethroprim-sulfamethoxazole and vancomycin) were found to be highly effective. Although only 54% of cases were prescribed effective antibiotics, prescription choice improved substantially over time.

Conclusion: The continued and steady increase of CA-MRSA cases at Ft. Benning highlights the need for more vigilant preventive measures at basic training sites. Clinicians at these sites should be aware of the growing CA-MRSA problem so that suspected infections are cultured and appropriately treated. Additional safeguards such as education, enforced hygienic practices among trainees, disinfection of common surfaces as well as enhanced surveillance that includes sensitivity testing of isolates are also needed.

Background

Staphylococcus aureus (SA) causes skin infections such as boils, abscesses, furuncles, folliculitis and cellulitis. Complications of infection include bloodstream infections, surgical wound infections, and pneumonia. Approximately 25-30% of the population is colonized with SA, while approximately 1% is colonized with the methicillin resistant form (MRSA).[1]

Although the majority of MRSA infections occur among patients in hospitals or other healthcare settings where frequent or long term antibiotic use and medical comorbidities are common, MRSA is becoming more prevalent in the community setting. Population-based survey data indicate that 8-20% of clinical MRSA infections are community-acquired (CA-MRSA).[2]

CA-MRSA outbreaks have been reported among military recruits, prison populations, athletic groups, and most recently among clients receiving tattoos from unsterilized equipment.[3-5] MRSA colonization among high-risk groups such as military trainees has been observed to be up to 3 times as high as rates in the general population.[2,6] Risk factors for infection with CA-MRSA strains include close skin-to-skin contact, openings in the skin such as cuts or abrasions, contaminated items and surfaces, crowded living conditions and poor hygiene.

Objectives

To describe the characteristics of CA-MRSA skin infections among a high risk population

To evaluate trends in CA-MRSA infections

To describe antibiotic susceptibility patterns of CA-MRSA isolates

Methods

CA-MRSA confirmed cases among Ft. Benning active duty (AD) Soldiers were identified by medical personnel at the Martin Army Community Hospital (MACH) and surrounding military treatment facilities based on clinical recognition and positive wound culture.

The MACH infection control nurse reviewed electronic medical and lab records for all CA-MRSA confirmed positives from Jan 1, 2001 – Dec 31, 2005 to identify patient characteristics and antibiotic susceptibility patterns.

The MHS Mart (M2) population summary data was queried to determine the monthly population for AD soldiers residing within a 20 mile radius of the MACH at Ft. Benning, GA, for the time period evaluated.

Date of positive CA-MRSA culture and DEERS monthly population data were used to generate monthly CA-MRSA infection rates.

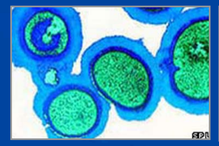
Descriptive analysis of data gathered (e.g. patient demographics, clinical management, and antibiotic susceptibility patterns) was performed.

CA-MRSA - Case Definition

A Case was defined as an AD Soldier with both of the following:

1. Clinically recognized skin or soft tissue infection that was non-hospital acquired

2. SA culture + with identified resistance to oxacillin or confirmatory resistance to cefotaxime



Results

The proportion of Staph aureus (SA) positive cultures which were confimed to be methicillin-resistant strains (MRSA) increaseasd each year. There were a total of 2,316 confirmed CA-MRSA positive cultures over the 5 year period evaluated, with 1,935 (83.5%) of the positive cultures received from AD Soldiers. **Figure 1**

CA-MRSA rates among the AD population increased each year. Monthly rates peaked at 7 cases per 1000 Soldiers in October 2005. Patterns appeared seasonal, with rates peaking in the summer and fall, and declining sharply in the winter. **Figure 2**

All isolates tested from the AD cases were sensitive to the recommended MRSA treatments (vancomycin and trimethoprim-sulfamethoxazole). **Table 1**

AD cases were predominantly male, and 22 years of age on average. A clustering of cases by unit was noted with roughly 68% of cases were associated with initial entry training (IET) units. **Table 2**

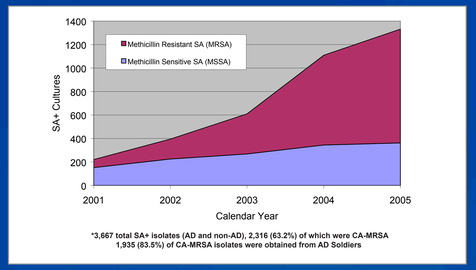
Wounds were predominantly located on the extremities, with joints such as the knees and elbows making up the bulk of these (39% and 36%, respectively). **Table 3**

Approximately 11% of infections were serious enough to warrant hospitalization which lasted on average 4 days. **Table 4**

Approximately 91.3% of patients were prescribed antibiotics and/or had their wounds drained. Approximately 54% of the antibiotics prescribed were effective against MRSA. **Table 4**

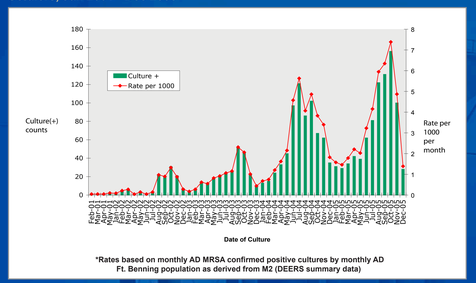
The use of recommended treatment regimens improved substantially over time, presumably as awareness of CA-MRSA increased. **Figure 3**

Figure 1. Resistance levels of Ft. Benning Staph aureus (SA) + Isolates, 2001 – 2005*

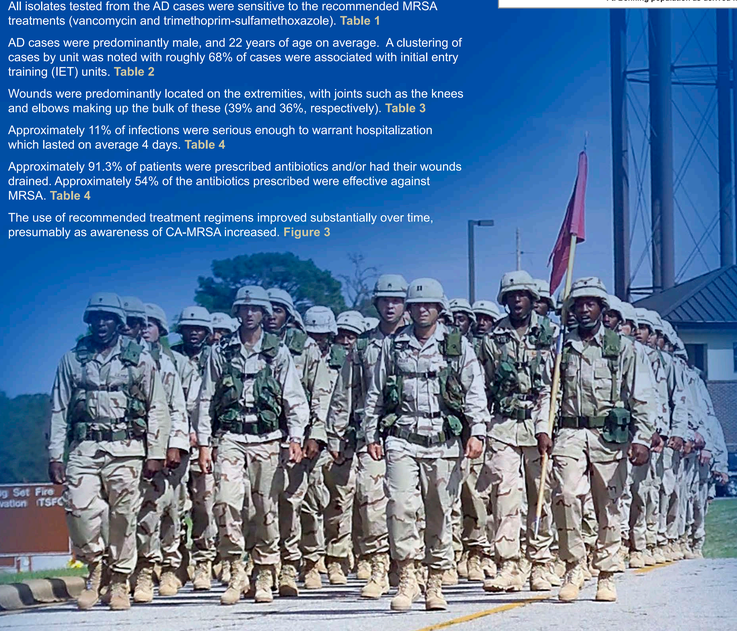


*3,667 total SA+ isolates (AD and non-AD), 2,316 (63.2%) of which were CA-MRSA
1,935 (83.5%) of CA-MRSA isolates were obtained from AD Soldiers

Figure 2. Monthly CA-MRSA Rates among Ft. Benning Active Duty Soldiers, Jan 2001 - Dec 2005



*Rates based on monthly AD MRSA confirmed positive cultures by monthly AD Ft. Benning population as derived from M2 (DEERS summary data)



Acknowledgements

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Table 1. Antibiotic Susceptibility (# of Isolates tested):

Antibiotic Class:	Generic Name	Isolates tested	Susceptibility Pattern
Penicillins:	Ampicillin	1935	100% Resistant
	Oxacillin	1935	99.9%R 0.1%S
	Penicillin	1935	99.8%R 0.2%S
	Amoxicillin-Clavulanate	1934	99.4%R 0.6%S
	Ampicillin-Sulbactam	1933	98.8%R 0.8%I 0.4%S
Cephalosporins:	Cefazolin	1933	98.7%R 1.1%S 0.1%I
	Cefuroxime	165	100% Resistant
	Cefotax	1933	98.6%R 1.1%S 0.3%I
	Ceftriaxone	1927	98.8%R 0.6%I 0.6%S
	Cefipime	263	97.0%R 1.1%I 0.9%S
Carbapenem:	Imimpenem	1933	97.7%R 2.2%S 0.1%I
Macrolides:	Azithromycin	1770	91.9%R 7.5%S 0.6%I
	Erythromycin	1933	84.9%R 10.4%S 4.7%I
Quinolones:	Ciprofloxacin	1935	62.5%S 32.8%R 4.7%I
	Levofloxacin	1934	67.5%S 18.4%R 14.1%I
	Gatifloxacin	1521	81.1%S 18.5%I 0.4%R
Tetracycline:	Tetracycline	1935	90.1%S 8.3%R 1.6%I
Others:	Clindamycin	1847	89.9%S 9.3%R 0.8%I
	Chlorampenicol	1934	98.5%S 0.9%I 0.6%R
	Rifampin	1935	99.1%S 0.6%R 0.3%I
Amino glycosides:	Amikacin	165	93.3%S 5.5%I 1.2%R
	Gentamycin	1934	93.6%S 5.1%R 1.3%I
Sulfonamides:	Trimethoprim_ sulfamethoxazole	1935	100% Sensitive
Glycopeptides:	Vancomycin	1935	100% Sensitive

S=sensitive, R=resistant, I=Intermediate

Table 2. CA-MRSA CASE Demographics (N=1733)*

Age:		
	<20	714 (41.2%)
	20-24	637 (36.8%)
	25-29	213 (12.3%)
	30+	168 (9.7%)
Mean:	22.1 +/- 5.2	
Range:	17-54	
Gender		
	Male	1700 (98.2%)
	Female	30 (1.8%)
Unit (#cases)		
Infantry Training Brigade:		
	2/19 (217), 2/58 (207), 1/50 (157), 2/54 (146), 1/19 (143), 1/329 (95)	965 (55.7%)
Basic Combat Training:		217 (12.5%)
	30 AG (133), 2/47 (46), 1/38 (38)	
CADRE		101 (5.8%)
Other (includes numerous permanent party & specialized training units)		450 (27.0)

*Multiple infections per case were observed; 1-4 infections per case for a total of 1,935 infections

Table 3. CA-MRSA Positive Cultures Wound Locations (N=1935)*

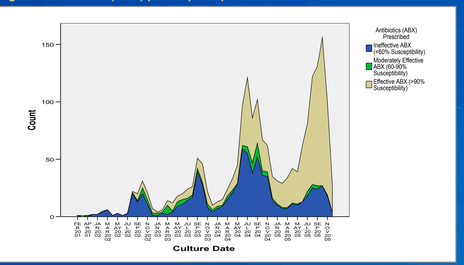
Lower Extremity		754 (42.1%)
Knees	297 (39.4%)	
Upper leg	250 (33.2)	
Lower leg	57 (7.6%)	
Leg, unspecified	79 (10.5%)	
Feet	80 (10.6%)	
Upper Extremity		574 (32.1%)
Elbows	201 (35.9%)	
Arm	144 (25.7%)	
Hand	116 (20.7%)	
Axilla/Arm pit	108 (19.3%)	
Genitals/buttocks		237 (13.2%)
Head/Neck		148 (8.3%)
Torso/Back		135 (7.5%)
Unknown		146

*1,733 total cases - multiple wound sites per case were observed; therefore, columns do not add to totals. Total percentages in the right column are based on exclusion of unknowns

Table 4. CA-MRSA Clinical Management (N=1935)

Hospitalizations:	
Infections requiring hospitalization	218 (11.3%)
*Days admitted: Total=1014; Mean = 4.6 ± 3.7; Range: 1-33 days	
Treatment Options:	
Wound drained and antibiotics prescribed	661 (34.2%)
Antibiotics prescribed w/out drainage	1,097 (56.7%)
Wound drained w/out antibiotics	8 (0.4%)
No treatment documented	169 (8.7%)
Antibiotics (ABX) prescribed:	
Cephalosporins (e.g. Keflex)	805 (41.6%)
Sulfonamides (Trimethroprim-sulfamethoxazole)	789 (40.8%)
Clindamycin	430 (22.2%)
Tetracyclines (tetracycline or doxycycline)	304 (15.7%)
Quinolones (e.g. ciprofloxacin)	160 (8.3%)
Penicillins	142 (7.3%)
Macrolides	66 (3.4%)
NONE PRESCRIBED	177 (9.1%)
^Multiple antibiotics may have been prescribed per case	
Efficacy of prescribed ABX:	
No/ineffective ABX (susceptibility <<60%)	771 (39.8%)
Moderate efficacy (susceptibility 60-90%)	113 (5.8%)
Effective (susceptibility >90%)	1,051 (54.3%)

Figure 3. Antibiotic (ABX) prescription patterns for CA-MRSA+ cases.



Limitations

The increased CA-MRSA rates observed may be attributed in part to improved surveillance efforts and increased wound cultures; it is not possible to determine to what extent the trends noted are influenced by this.

The rates reported are likely an underestimation due to a failure to seek care by the infected individual or a failure of the clinician to culture all symptomatic patients.

Case exposure data and isolate genotypes were not available.

The demographic and denominator data needed to fully assess the impact of MRSA on military personnel considered most at risk, (e.g. trainees and other occupational groups) was not available.

Genotyping of the isolates was not performed and full antibiotic susceptibility patterns were not available for all MRSA isolates. Continued analysis of susceptibility patterns that includes genotyping would illustrate the optimal therapy for the predominant isolate in the trainee populations.

Conclusion

The rise in CA-MRSA cases observed at Ft. Benning is an all too common trend. The rates reported represent only the tip of the iceberg since many infections go undiagnosed or uncultured. Although complete diagnostic data are not available, clinicians are becoming increasingly aware of the growing CA-MRSA problem; clinicians at Ft. Benning, for example, transitioned from less effective antibiotic treatments to the recommended MRSA antibiotics for their cultured patients during the 5 year study period.

Management of CA-MRSA requires a team effort and a number of critical public interventions aimed at breaking the chain of transmission and preventing the introduction of new cases. Additional countermeasures include educating troops to identify potential MRSA skin infections, enforced hygienic practices among trainees, and disinfection of common surfaces. Continued and enhanced surveillance to include risk assessments, isolate genotyping, and antibiotic susceptibility testing are also needed to allow identification of the predominant circulating strain and determination of the optimal treatment regimens and potential sources of the outbreak.